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## The Bobbin and Beaker Vol. 16 No. 4

Clemson University

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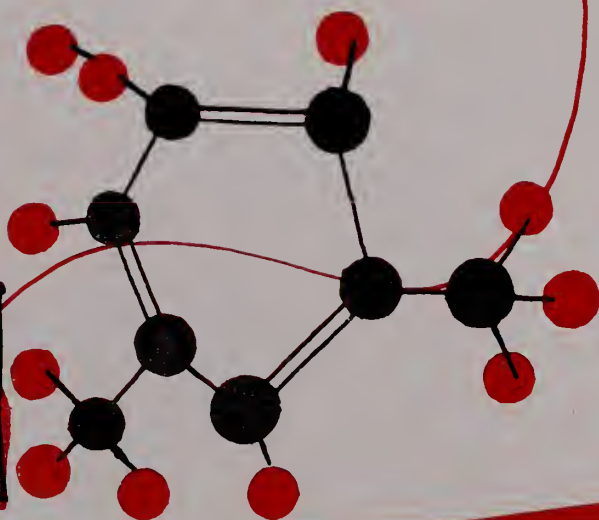
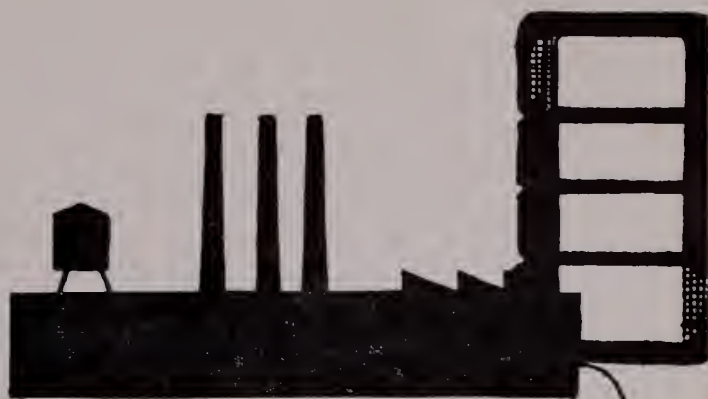
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# THE Bobbin & Beaker

Official Student Publication  
Clemson Textile School

VOL. 16

SUMMER ISSUE

NO. 4

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**Cover Explanation:** The cover is in keeping with the general theme of the summer issue—man-made and cotton fabrics and blends of these fibers. The product of the synthetic plant in the lower corner is joined to the product of the cotton mill in the upper corner in forming a blend fabric in the center, and this depicting theme of this issue.  
—Cover Design by Russ Campbell

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# From the Editor . . .

It seems to be the custom of incoming staffs to address the readers and let them know what is in store for them in the coming year. Rather than deviating from this practice, the 1958-1959 staff of THE BOBBIN & BEAKER looks forward to letting the readers of our publication know what to expect in our publication.

This year, for perhaps the first time, the staff will attempt to present to you an entire issue based on a central theme. This seems to be a rather large undertaking for a student group, but with the help of men prominent in the textile industry and textile education, we have undertaken this plan with the hope that our readers will find our publication as interesting and informative as in the past.

This present issue, for instance, has for its central theme, cotton, wool, and man-made fibers and blends of these fibers. Included in our articles is one on synthetics in the carpet and rug industry, and one on man-made fibers and blends in novelty fabrics. We also have articles on blending for better textiles with a follow-up article on improved blend fabrics. The cotton and wool industry are by no means left out, as will be seen when you read our guest articles on the future of these two fibers.

This issue has been long in the planning and we hope you share our enthusiasm when you read our wide variety of interesting, informative guest articles.

—Wayne Freed, Editor

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# Synthetics in the Carpet and Rug Industry

A. U. Priester, Jr.

Vice President and General Manager  
Hillcrest Division, Callaway Mills Company  
LaGrange, Georgia



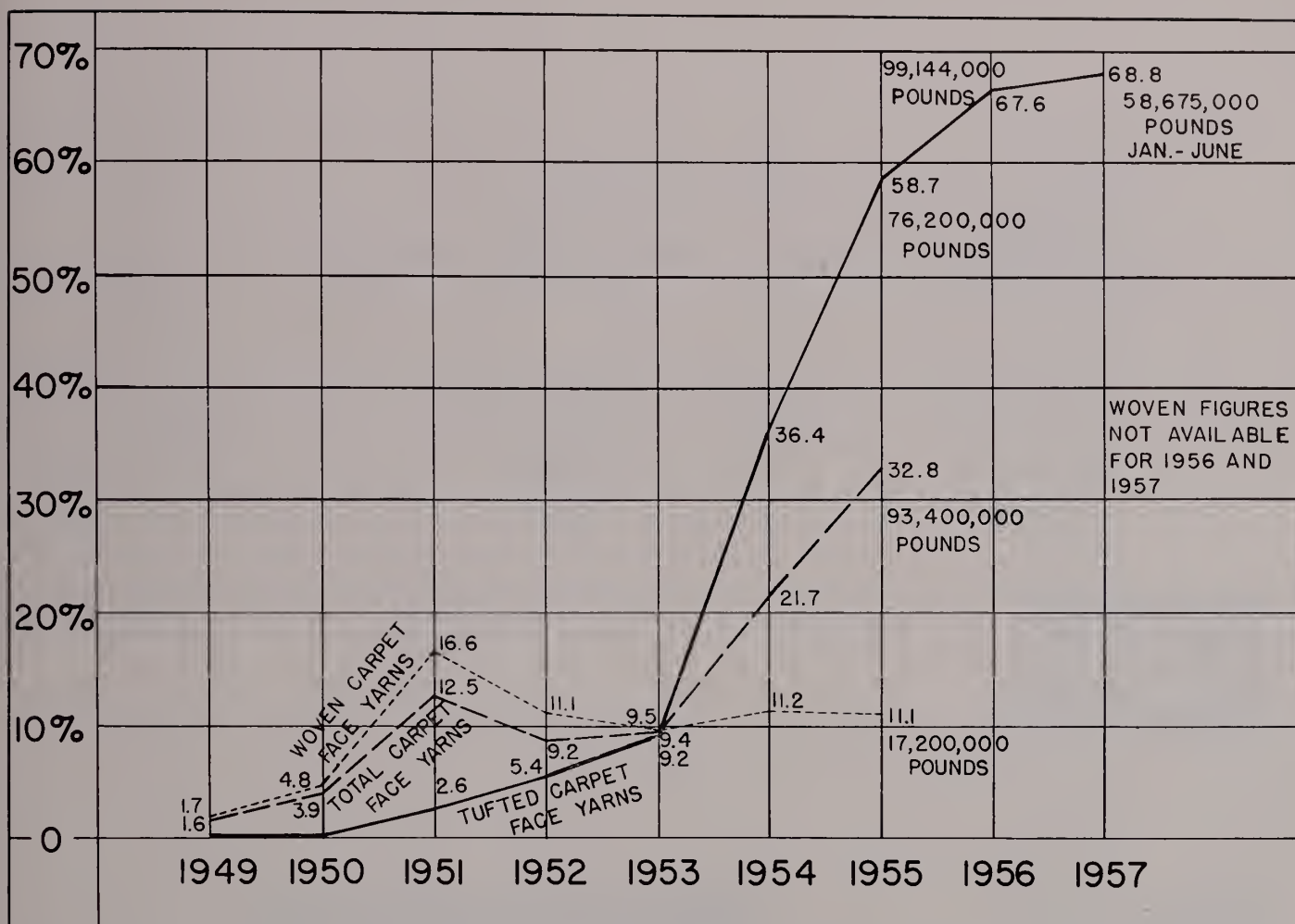
The development and use of man-made fibers in rugs and carpeting has been one of the most interesting chapters in the history of the floor covering industry. Side by side with this trend and interwoven with it has been the spectacular growth of tufted rugs and carpeting. Together these developments have created a revolution in the industry. Most amazing is the fact that this has occurred largely since World War II.

The meteoric nature of these changes is graphically emphasized by the statistics available. Synthetic fibers, which represented less than 2% of the total fibers used in rug and carpet face yarns in 1949, claimed 33% in 1955, including 11% of the woven face yarns and over 58% of the tufted face yarns. In 1956 synthetics claimed over 67% of the tufted carpet poundage and in the first half of 1957 close to 69%. Tufted carpeting, which represented only 9% of the total square yards of rugs and carpeting in 1951, claimed 46% in 1956 and in the first half of 1957 reached 51%.

Let us look at the background that made these changes possible. For hundreds of years the traditional woven wool rug had gone unchallenged. Wool was carpet king and everyone accepted that fact. Of course, there were a few cotton bathmats and scatter rugs and a few fiber rugs for porch or sun parlor, but these did not seriously offer even a slight threat to the market for wool rugs. However, when the price of wool skyrocketed during World War II, experimenters began to look around for a substitute for wool. This was essential, for with the outbreak of

the Korean war the price of carpet wool, all of which is imported, climbed from 70 cents a pound in November 1949 to something like \$2.40 in the spring of 1951 and consumers were showing a sturdy resistance to corresponding prices of the finished produce. Therefore, carpet manufacturers felt compelled to turn to cotton and synthetic fibers to supply the consumer demand for inexpensive or moderately priced rugs.

In addition to questioning the traditional wool, experimenters became bolder and began to question whether rugs had to be woven. For some time bedspreads and small scatter rugs had been machine-made by a tufting process, and farsighted textile men began to consider the possibility of producing large rugs by this same method. Briefly, in this less expensive process, carpeting is made by punching yarns in tufts into jute or duck or canvas fabrics, the loops being either cut or left uncut. A rubber-like coating is placed on the back in order to add body, to lock the loops tightly, and to provide skid resistance. Experimentation showed that large carpets could be made by tufting, and a rapid change from 12-needle machines to those of over 1600 needles followed, the first broadloom tufted carpeting having been made late in 1950. One big tufting machine, it has been reported, can produce as much carpet as ten to fifteen regular carpet looms. Development after development in rapid succession made possible such improvements as better styling, yarns specifically engineered for tufted carpets, pattern mechanisms to control the height of individual tufting yarns, the reinforcing of carpet backing with scrim or other material to obtain dimensional stability, improved dyeing procedures, and techniques for printing tufted carpets.



**Man-made Fibers in Carpet Face Yarns.** This shows the percentage by years of the total face or pile yarns that were made of synthetic or man-made fibers. Note that 67.6% of all carpet face yarns used in 1956 were synthetic, compared with about 9% in 1953. (This chart is based on figures in "Textile Organon" Supplement, October 1957, except 1956 and 1957 tufted figures from U. S. Bureau of Census "Facts for Industry.")

Wool prices and the development of tufted carpeting have both influenced the distribution of fiber consumption. In 1937, 80% of the rugs and carpets were wool. This percentage remained about the same through 1949. In 1950, due to the high cost of wool, the percentage dropped to 62% and in 1951 to a low point of 35%. In 1952 the trend reversed and by 1955 the figure for blended wool and man-made fibers in woven carpet output had dropped to 20% and in 1956 to 17%. This means that wool has tended to regain its position in woven carpets and it is in tufted that man-made fibers have made their greatest advances.

Almost all the first tufted carpeting was cotton, but the trend to rayon and acetate was soon apparent. The use of rayon and acetate in the tufted textile industry grew from 1,011,000 pounds, or less than 2% of the total, in 1951 to 88,332,000 pounds in 1956, representing 51% of the total fibers used and thus displacing cotton as the major fiber in tufting. These figures cover the entire tufted field, including not only rugs and carpeting, but also robes, bedspreads, etc. A breakdown was not made in these statistics until 1956, when rayon and/or acetate in tufted rugs and carpeting represented 87,113,000 pounds or 59.4%;

cotton, 40,599,000 pounds or 27.7%; wool (for all tufted products, but non-carpet uses probably negligible), 6,817,000 pounds or 4.6%; and other fibers (primarily nylon and nylon-rayon mixture yarns), 12,031,000 or 8.2%. The first six months of 1957 showed the following distribution: cotton, 19,738,000 pounds or 23.1%; rayon and/or acetate, 51,818,000 pounds or 60.7%; wool, 6,971,000 pounds or 8.1%; and other fibers, 6,857,000 pounds or 8.0%. This means that synthetics claimed 99,144,000 pounds or 67.6% of the poundage in tufted carpeting in 1956 and 58,675,000 pounds or 68.8% in the first half of 1957.

Tufted floor covering has changed carpet production into a fast moving, dynamic industry. The period since 1948 has been a tumultuous one. It has been said that this period has probably seen more changes in products alone, to say nothing of technical developments, distribution and merchandising techniques, than the previous hundred years. Top designers have been engaged to supply stimulating vitality, and new patterns and weaves have been introduced. Fibers that initially were used as industry's answer to a dwindling wool supply and an unstable wool market are not substitutes but a permanent addition to the



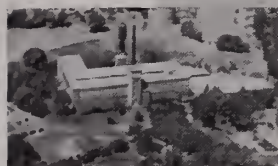
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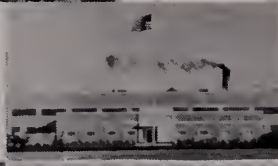
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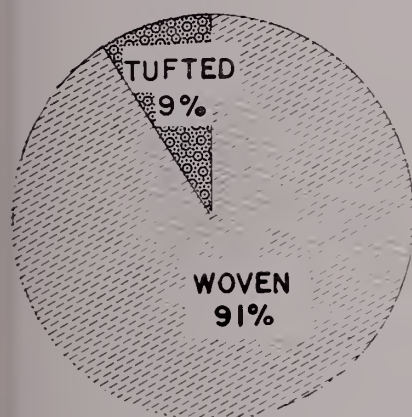
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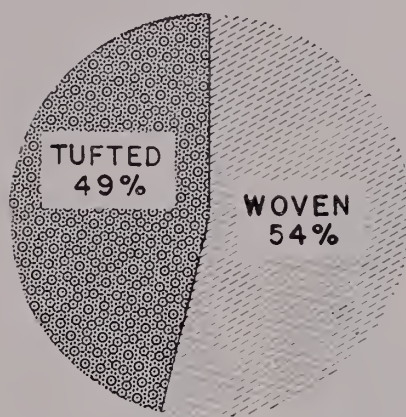
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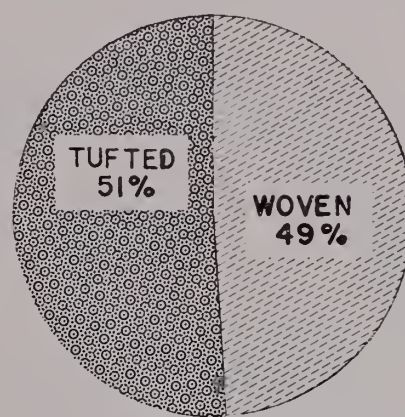
1951  
66,676,000 SQ. YDS.



1956  
118,228,000 SQ. YDS.



1957 JAN.- JUNE  
64,183,000 SQ. YDS.



Production of carpeting and rugs (larger than 4' x 6'). This shows that the production of carpets and rugs virtually doubled between 1951 and 1957, and that the tufted types represented 9% of the 1951 production and over half of the January-June 1957 carpet.

raw material picture. And new fibers and blends are constantly being added.

Rayon, of course, has supplied the bulk of the synthetics used in carpets and rugs, over a million pounds having been used annually in 1955 and 1956. According to estimates, rayon consumption in 1957 reached a record 115 million pounds. It was natural that manufacturers turned to rayon, for it made possible luxurious, colorful, textural, low-priced carpeting. Constant concerted research, with fiber and yarn producers working closely with carpet and rug manufacturers, has produced improved rayon carpet yarns. Smooth surface carpet staple was designed to give loop pile carpets greater soil resistance and ease of cleaning. Harsher crimped staple increased resiliency and wearability. Solution-dyed and vat-dyed yarns guarantee colorfastness. Bulked or lofted filament yarns provide greater covering power, elasticity, a wider variety of textures, and clearer color and pattern definition because of freedom from pilling and fiber migration. These yarns are especially well adapted to the currently popular tweeds and moresques. A major impetus to large scale development of bulked filament in carpets has come from the success of bulked solution-dyed acetate filament since it was introduced the latter part of 1956. The man-made fiber figures undoubtedly incorporate a growing proportion of synthetics other than rayon, notably nylon and in the last year or so, several acrylic fibers.

The current trend to tufted carpeting has been due only in part to the wool situation, for it also fits into a larger changing economic pattern. The most significant recent change is the rise of a great new moneyed middle class, continuing to grow larger and wealthier—the result of the nation's increasing pro-

ductivity. The United States is fast becoming a one-class market of prosperous middle-income people. This means that millions of Americans are reaching the point of having more than the absolute necessities, and it would seem to indicate the tremendous need for moderately priced carpeting and rugs. Furthermore, not only is the middle-income class growing but the population as a whole, despite a virtual cessation of immigration, is increasing faster than it has in forty years. American women are once again raising large families and the birth rate is soaring. All this means more houses and consequently more potential customers for carpets. And these customers are likely to live in the suburbs where the dominant way of life is simple and informal. More Americans are staying at home and taking pride and interest in making their surrounding more attractive. The soft floor covering market is an unsaturated one. In 1945 only 9% of American floors had any rugs or carpets on them. Even in the best year since then, the industry has sold only 2.3 square yards per family. This leaves most of the 91% of American floors still bare.

Tufted carpeting, moderately priced and with its variety of warm colors, fits into this picture perfectly. As it has been continually upgraded, it now competes not only in price, but also in style and quality. Accordingly, more people can afford more carpeting and can select from a much wider range of colors and patterns than ever before. Decorators love the array of color possibilities, and more women are learning to do their own decorating tastefully. Tufted carpeting and man-made fibers have already demonstrated that they are what America wants, for they are rich with the beauty of the rainbow and as modern as the dreams of tomorrow's homeowners!



# The Place of Man-Made Fibers and Man-Made Fiber Blends in Novelty Fabrics

By Jackson Weldon  
Plant Manager, Seminole Mills  
Clearwater, South Carolina

Not too many years ago the term "Novelty", as applied to woven fabrics usually indicated that the cloth was either made from fancy twisted yarns or was woven in a very intricate weave pattern. In most instances the novelty weave pattern prevailed, regardless of the character of yarn. In fewer instances novelties were produced in yarn combinations of silk and wool, worsteds, etc., also usually with the novelty weave. In those days, say, the 1920's, and prior to that time, the manufacturer of novelty fabrics depended largely on an intricate, expensive weave pattern. Novelty yarns were largely limited to, in order of importance, fancy twisting, blending of raw stock dyed flakes or nubs and inter-blending of two or more of the natural fibers together. The four principal fibers of importance in novelty goods were cotton, wool, silk and flax, all natural fibers. Very great ingenuity and imagination had been exercised by the textile industry and imagination had been exercised by the textile industry in developing fabrics from those fibers to, as nearly as possible, meet the greatest needs of man.

Progress and development of the chemical industry created the commercial introduction of many man-made fibers to textiles during the past 30-35 years. The very first of these fibers, rayon, promptly put down its roots in the industry, doubtlessly coming as a surprise to many who might have considered the textile fiber potential as being forever complete. Once the fiber barrier was broken man began to introduce numerous other new fibers, such as, to name a few, acetate, nylon, dacron, acrilan, dynel, glass, metallic yarns. Others, too numerous to mention, are in small production or the experimental stage.

To measure the success of the man-made fibers to date one needs only to consult the records and note that between 1937 and 1955 the consumption of man-made fibers has risen from 7%, of all fibers, to 26%. This remarkable success is attributable only to the great number of assets and advantages brought to novelty fabrics, as well as others, by the man-made fibers. Chemists are able to compose into them spe-

cific desirable properties and potentials, many of which are unprovided for by nature in the natural fibers.

Blends of man-made fibers and blends of man-made fibers with natural fibers provide almost unlimited color possibilities in the finished fabrics. The two very earliest of the man-made fibers, viscose and acetate, greatly expanded the field of cross dyeing, making it possible for the stylist to provide combinations of colors, in the same fabric, ranging from light to sharp contrasts. While the viscose and acetate fibers are the most widely used combination for cross dyeing, similar effects can be obtained by the use of combinations of many of the other fibers. For cross dyeing purposes the greige fabric is usually woven either with heather blended yarns, or with two or more yarns, each composed totally of different fibers. Other types of yarns often produced for cross dyeing are plied yarns, each ply member containing contrasting fibers, and certain types of fancy yarns containing contrasting fibers, and certain types of fancy yarns containing nubs, flakes, splashes, etc., with these additives being composed of contrasting fibers. After weaving any one fabric with any of the above combinations it is then possible to choose from a number of color combinations for the dyeing. Raw stock dyed fabrics, in addition to being very expensive do not have this versatility of color selection after weaving.

Man-made fibers also offer the option of selecting the "hand" of any fabric to be produced. If crispness is desired the fiber deniers can be coarsened. If a soft feel is desirable the finer deniers can be chosen. To produce a wooly effect a small percentage of extremely coarse deniers can be included in the blend. Proper selection of deniers and staple lengths, coupled with proper mechanical preparation of yarn, produces a superior linen fabric. If great strength and wear resistance are desirable man-made fibers can be selected to provide these characteristics to a degree not possible in natural fibers. Some of these fibers have also brought to the consumer added values in wrinkle recovery and ease of care.



The fabrics discussed above acquire the description, "fancy", or, "novelty", as the case might be, from the blends, yarn structure and end results of finishing. Certainly, fancy weaving and raw stock dyeing are unrequired to place them in the novelty or fancy category. The result is a lower weaving cost. The raw material cost, per pound of woven goods, is also usually lower in novelty fabrics made of man-made fibers than in those made of natural fibers. This is of tremendous economic importance since it provides beautiful fabrics to the consumer at moderate prices.

The existing man-made fibers have many undeveloped possibilities. Many are only a few years old and the mills have not had enough experience with them to overcome all the spinning and weaving problems. Similarly certain problems in dyeing have not been completely solved. Meanwhile, more promising fibers are being produced at the rate of several per year. Each is designed to improve upon the older fibers or to make something entirely new. Having accomplished so very much in so little time it is only logical to foresee a rapid growth of widely diversified novelty and other fabrics of man-made fibers. This revolutionary phase of the textile industry is now only in its infancy. The natural fibers have valuable assets that doubtlessly insure their permanent usage. The destiny of man-made fibers and fabrics lies in designing them to fill the wide gaps in usefulness and to stimulate new conceptions of beauty and appeal.

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# Blending for Better Textiles

By Charles H. Rutledge  
Manager, Product Information Section  
Textile Fibers Department  
E. I. du Pont de Nemours & Co., Inc.

Recent developments in the study of blending indicate that the key to tomorrow's better textiles lies in large measure with the scientifically engineered union of natural and man-made fibers.

All fibers have their own "personalities." They have their good points and some weak points. In blending, the trick is to produce a fabric with a maximum amount of good points. In many instances, the strong points of one fiber will balance out the weak points of another. This is the answer to the question: "Why have blends?"

Actually blending in the textile industry is not particularly new. The practice has been going on for years. Initially, the natural fibers were blended. Wools of different grades and assortments have been blended for generations to produce fabrics with appropriate texture, hand, and price for a given use.

With the advent of man-made fibers—the cellulose—we added further versatility through blending. In recent years, the development of the chemical fibers has added new working tools, new ingredients to open even wider vistas through blending.

While the basic properties of the newer fibers made them naturals in many cases for industrial use—with sound and proper developments, of course—their use in apparel means that they must meet fastidious specifications of aesthetics, fashion, and other factors. Therefore, it is no longer sufficient to rely entirely upon experience and plain artistry in blending fibers.

Like the metallurgist and rubber chemist, we must know what we are doing. The complexity of fiber characteristics and properties requires a thorough understanding of the fibers and a sound approach in utilizing them. Sensibly handled, they provide fabrics with beauty, strength, functionality, and concepts of design that were unheard of a few years ago.

As each of the new synthetic fibers emerged from the laboratory, its strong points were recognized immediately. However, as developments progressed and we gained experience, it became apparent that the outstanding contributions of the new materials carried with them restrictions that could not be ignored.

We are all familiar with the early difficulties encountered in dyeing the new fibers. Fuzzing has been a problem, particularly with the tougher, durable fibers. We have grappled with static, which is common in greater or lesser degree to all of the chemical fibers and is no stranger to wool.

Early recognition of the contributions, as well as the limitations, of the newer fibers immediately suggested blending as a practical means of capitalizing on the outstanding positives and at the same time controlling the negatives. Blending becomes even more attractive when we recognize that the newer fibers such as nylon, "Dacron" polyester fiber, and "Orlon" acrylic fiber have outstanding properties that complement the natural and cellulosic fibers. In many cases, the converse is true, the natural and cellulosic fibers augmenting the chemical fibers where they need help. This we deem a realistic approach.

Consequently, we have devoted several years of research into blending with the following objectives in mind:

- (1) To obtain a thorough understanding of the inherent characteristics of individual fibers.
- (2) To explore their reactions with each other in blends.
- (3) To develop the means for effective use of all available fibers—natural, cellulosic, and chemical.

The goal in all this has been to provide help to the textile industry and to promote better use of the chemical fibers for the development of fabrics that are sound from the standpoint of consumer dollar value.

One effect of this research has been to combat the "gimmick" use of these fibers. We have developed information that has been passed along to the trade that insignificant percentages of the newer fibers in a fabric contribute exactly nothing in the vast majority of cases.

For example, when you have a high percentage of rayon in a rug with a small percentage of nylon, you still, for the most part have a rayon rug. That principle holds true almost across the board, an exception



being that small percentages of nylon in the reinforcing of socks will increase wear life. The same is true in the use of nylon with cotton in denims, work gloves, and the like.

For the most part, however, if you want the performance of pleat retention, crease retention, wrinkle resistance, ease of care, and other plus properties offered by the newer fibers, then there must be a sufficiently high percentage of those fibers in a fabric to provide the desired results.

Unfortunately, there have been too many cases where extreme claims have been made for insignificant percentages of nylon, "Orlon," and "Dacron." At no stage is there a miracle—even in 100 per cent constructions of the newer fibers — and certainly the miracles will not be forthcoming in low-percentage blends.

Those "gimmicks" not only result in widespread consumer dissatisfaction, but ultimately they will result in stringent labeling regulations.

It has been 19 years since the world's first commercial nylon plant went into operation. That eventful day was December 12, 1939, when men in Seaford, Delaware, kept their fingers crossed as the power was turned on in the Du Pont Company's new venture.

That first plant—which was built concurrently with a pilot plant and therefore was not scaled up from the smaller version — operated successfully, quite fortunately. That supreme effort culminated more than a decade of costly, soul-testing struggle. A new textile fiber had come into being.

The picture in 1939 was this. We had the four major natural fibers—wool, cotton, flax, and silk. We had the then two rayons—viscose and cuprammonium. We had acetate and a struggling infant, a textile fiber from glass. Thus, surprisingly enough, nylon became our ninth fiber. Since then the textile industry has added many more fibers.

Confusing? In a way, I'll agree there is confusion,

but it's not the tragic type that follows disaster as too many unrealistic people would believe. In reality, it's the wide-eyed, happy confusion of the small boy in a candy shop with his first nickel to spend as he pleases.

Here is the great textile industry which grew with the nation by doing an outstanding job for the greater portion of that period with four natural fibers. Then was added the cellulosic group, and glass, and nylon. Today this industry finds itself with no less than 20—some exciting, basic tools with which to work.

No single fiber is qualified to satisfy all of our present-day needs. The once-popular idea of selling a fabric as 100 per cent of this or that is becoming less and less important. Just as alloys are blended for specific applications, so are more and more fibers being blended to produce fabrics for specific functions and performance.

Furthermore, textile research is showing that the newer chemical fibers are more and more complementary to the natural fibers, as they are to the cellulose, when used in blends and combinations.

This bears a striking resemblance to great developments in the metallurgical industry which have opened new avenues of enterprise in manufacturing, transportation, and construction.

Without alloys of iron and manganese, chromium, and tungsten, these industries could not have made the great progress they have made. Alloys of titanium with iron, and aluminum with chromium are solving many problems in aviation. No single alloy could do the job alone. Similarly, no single fiber is qualified to satisfy all of our present-day textile needs.

In using the newer fibers, particularly in blends, the approach on some occasions has been on a haphazard basis. This is both needless and unfortunate. The firms that are developing sound fabrics are approaching their problems through engineering.

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# Improved Fabrics Through Blending

By E. K. Bispham  
Textile Fibers Department  
E. I. du Pont de Nemours & Company, Inc.

Today, the textile industry has 20-some fibers to use as tools in engineering fabrics. There are the natural fibers—wool, cotton, silk, and flax. There are the cellulosic fibers—viscose rayon, cuprammonium rayon often known as Bemberg rayon, acetate, and “Arnel” tri-acetate. The newest fiber tools as a family are the synthetic or chemical fibers such as nylon, “Dacron” polyester fiber, “Orlon” acrylic, “Acrilan,” Dynel, and saran to name a few.

With the 20-some fibers available today, well over one million blends are possible. There is no simple prescription for the blending of these fibers. It is necessary to test each fabric construction in a proposed end use to determine its suitability for the specific use in question.

There is no such thing as a perfect, an all-purpose, or “miracle” fiber or fabric. Nothing is perfect, nothing is all purpose, and those truisms apply as much to fibers as to all other things.

In blending, the object is to retain the best advantages of the blending components and minimize the less desirable features of each component in order to create a product of the most value.

I would like now to discuss some of the better known and consumer accepted blends of chemical fibers with cellulosic and natural fibers:

**65 per cent or more “Dacron” polyester fiber with cotton**—This is a highly accepted blend in summer suits, shirts, blouses, dresses, and lingerie. When properly constructed, such garments offer ease of care features such as wash and wear, durability, wrinkle resistance, and shape retention because of the high content of “Dacron.” At the same time the cotton reduces the possibility of static charges building up and of hole melting and lends some of its own desirable characteristics of absorbency, texture, handle, and of course lower cost. Reducing the amount of “Dacron” in the blend will result in loss of functionality—giving a fabric which is no longer wash

and wear and less wrinkle resistant. Increasing the amount of “Dacron” polyester fiber in the blend will add functionality, but at the same time cotton’s contribution to the fabric will not be as great.

**55 per cent or more “Dacron” with rayon**—In blends, “Dacron” and rayon are very compatible. The “Dacron” contributes durability and ease of care which are lacking with rayon. Rayon, on the other hand, complements “Dacron” since it does not generate static and it adds resistance to hole melting. For some uses, blends of “Dacron” and rayon do not have quite as good aesthetics as blends of “Dacron” and wool; however, noteworthy advances have been made with these blends. Also, as one might expect, the price tag is smaller. I want to emphasize that a minimum of 55 per cent “Dacron” is needed in blends with rayon before the contributions of “Dacron” can be expected to show. These blends are becoming of increasing importance in slacks, suits and uniforms.

**50 per cent or more “Dacron” with wool**—At the blend level of 50 per cent “Dacron” and 50 per cent wool, excellent lightweight suiting and dress fabrics may be obtained. Many stores are finding tropical worsted-type suits containing 50, 55, or 60 per cent “Dacron” with wool are their best selling spring suits. Wool is excellent in its aesthetic characteristics of handle, texture, liveliness, and bulk. It is generally accepted as having a high level of performance and beauty. “Dacron,” properly blended with wool, produces fabrics that combine excellent aesthetic character with outstanding wrinkle resistance, press retention, and durability.

**80 per cent “Orlon” acrylic fiber and 20 per cent wool**—This is a very popular blend in jersey knit goods. The wool permits cross-dyeing coloration effects. It contributes a difference in handle and texture when compared to jersey of 100 per cent “Orlon” acrylic fiber. The “Orlon” contributes its own luxurious “hand,” plus functionality — wash and wear

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**55 per cent or more "Orlon" with wool**—This blend is used in woven fabrics. "Orlon" is inherently a soft fiber and this property is used to advantage in blends with wool to make soft tweeds, shetland types, flannels, and fleeces. The wool imparts its own aesthetics, such as texture and drape.

**15 per cent or more nylon with wool, cotton or rayon**—A small percentage of an exceptionally strong and abrasion resistant fiber, of which nylon is the outstanding example, is often blended with weaker, less abrasion resistant fibers such as cotton, rayon, and wool to obtain a fabric with greater wear life. For example, the addition of 20 per cent nylon to a wool carpet will add 30 to 50 per cent wear life over a similar all wool carpet. Cotton twill fabrics, such as denim work clothes, containing 25 per cent nylon blended with the cotton in the warp yarns will wear twice as long as 100 per cent cotton denims in the same constructions.

I wish to stress that small percentages of the tough, new chemical fibers do not impart to any substantial degree their potential functional characteristics other than additional wear life. Unfortunately, many claims which are not true are often made for fabrics containing small percentages of high property chemical fibers such as "Dacron" polyester fiber and nylon. One example of this is rayon carpeting containing 10 per cent or less nylon being sold as 100 per cent nylon, or being sold as having many of the outstanding characteristics of all nylon carpeting.

We have seen how several blend fibers may be combined to emphasize the desirable attributes of each to produce fabrics far above those attainable with either fiber alone.

The selection of fibers and blend levels is very important, but it is by no means the whole story. The job of bringing these fabrics to the consumer requires a great deal more. The best selection of fibers will accomplish nothing unless the weavers, knitters, and converters thoroughly understand the materials with which they are working. That is why we have an extensive technical service program—to work with these mills and manufacturers to produce good merchandise.

The final link in the chain is sound advertising, promotion, and distribution. The ultimate consumer is dependent upon the fiber producer, fabric manufacturer, and the cutter for the quality of his purchase. He is even more dependent upon the retailer and sound advertising to protect his interests, and to educate him on the performance he may expect of his textile end products.

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# Cotton Textiles and the Future

by

W. Gaines Huguley, President  
F. W. Poe Manufacturing Co., Greenville, S. C.

No segment of the textile industry seems to be without problems these days. Several years of tough sledding, plus a lot of publicity about poor profits, Japanese competition and other negative factors, may have many people wondering if there is a future for textiles.

Definitely there is a future, a great one in my opinion. We have had severe problems, many of which are still unsolved. But present problems are not perpetual problems, and the long-range prospects for the textile industry are excellent.

Textiles is one of America's most important basic industries. More than two million people, including apparel industry employees, make their living in it. About 13 per cent of all manufacturing employees in the nation are engaged in textile or related production. Here in the South, our industry is in the forefront as an employer, wage payer and tax payer.

Take away the textile industry, and the economy of the South would collapse over night. And 24 hours later the entire nation would forget atomic bombs and outer space in a desperate effort to resurrect an industry we cannot do without.

So there is a future, a good future for textiles, and as long as we have textiles, we will have cotton textiles, too. The "battle of the fibers" which used to be a popular phrase, has tended more and more toward the "marriage of the fibers." It is getting hard to find mills that are strictly "cotton" or strictly "synthetic" as blends of fibers have become increasingly popular and important.

This does not detract from cotton, but opens up new possibilities for it in my opinion. The cotton industry, from grower to broker, is dependent on the textile industry, and vice versa. Therefore, they will jointly work out such problems as exist for them today.

Here in South Carolina we produce about 40 per cent of all the cotton fabrics in the United States. We have 31 per cent of the cotton spindles and 36 per cent of the cotton looms. In the South as a whole, we already have over 90 percent of the broadwoven cotton

fabric production, 72 per cent of the man-made and silk fabric production, and I would guess we are approaching approximately half of the woolen and worsted fabric production.

So we are a tremendous cotton-using country, and will continue to be. It is true that consumption of the man-made (synthetic) fibers has increased. Yet the rapid increase of our population, the new uses for fibers and textile products of all kinds, will inevitably benefit cotton as well as man-made textiles.

This is not to say that we can sit back and wait for something nice to happen. If cottons are to survive the competition from other fibers, additional research and development and far greater **promotion** must be undertaken. We, as is true of all phases of our industry, must deliberately plan on how to regain the share of the consumer dollar which used to go to textiles. In the past seven years, Americans increased their spending for durable goods, services, etc., by about 35 per cent—but consumption of clothing, shoes and related items went up a meager four per cent.

So the declining share of the consumer dollar spent for textiles is indeed a problem, and one that challenges the industry to come up with a vast program of promotion and **merchandising** which will increase purchases of our products.

It is reasonable to assume that just offering the same old products will not do the trick, no matter how well they are promoted. We must develop **new** and **better** fabrics, new constructions, styles, blends, dyes, finishes. Brainwork is required. Scientists, chemists, technicians and specialists will work side by side with production men. Designers and stylists will team up with the sales force and mill men.

The net result, as always in this fabulous American economic system of ours, will have to be better, more attractive, more serviceable products at prices the public will pay. It will mean that the efficient and imaginative producer will continue to survive as the inefficient and inflexible drop out. It means competition to an even greater extent than we have known it in the past.

It also means that the textile industry, in all its many segments, must have top-flight young intelligent manpower. I am constantly amazed to hear about declining enrollments in textile schools. There is **no** industry which offers greater opportunity for satisfying and rewarding careers than textiles. We need a great bulk of good, substantial average people, of course, but the desperate need continues to be for the exceptional student, the **above-average** young people who can come into the industry and work themselves steadily upward into positions of high line and staff management.

In Burlington Industries, parent company of the organization of which my company is a part, the matter of management development is of primary importance. Not only textile graduates, but graduates whose interests run to administration, sales, personnel and industrial relations, industrial engineering, and other specific areas of staff services or manufacturing are constantly sought.

Burlington, which began in 1923 as a rayon weaver and has always been a noted producer of synthetics, has in recent years expanded its operations into the cotton field. It, too, believes in the future of cotton textiles.

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# The Future of Wool

By George Bailey  
Clemson '50  
Wellman Combing Company

Long before the dawn of history, the Stone Age hunter realized that the fleece of wild sheep was softer, warmer and thicker than the hairy skins of other animals. With this discovery, he made one of the major contributions to human progress.

Most of us now use wool through the year as a matter of course. The use may be in a coat or suit, socks, sweaters, upholstery, rugs, and blankets. Whatever the use, we use wool without even realizing why we've chosen it, but more likely because "virgin wool" or "all wool" on a label has always connoted security, comfort, "the best."

No other fiber behaves like wool and that is why an item made from wool serves so well. The wool fiber has many unique properties, one being elasticity. It can be pulled as much as 30% beyond its normal length or it can be crumpled tight and when released, it will rapidly recover its natural shape and size. The same thing happens with wool fabrics, which may be temporarily distorted in ordinary wear and yet, after hanging in an airy space, return to their previous shape and thickness of texture.

Wool fibers are capable of soaking up as much as 30% of its weight in moisture without feeling damp. This makes wool fabrics more comfortable to wear, because it drinks up perspiration in warm weather and absorbs, instead of transmits, the cold dampness of winter air.

Tightly-woven wool can insulate the body from both extremes of temperature. The best example of its versatility is the use given wool by Desert Arabs who wear wool in turbans and burnouses to protect themselves from the extremely hot, dry air and the fierce mid-day sun, as well as from the sudden cold of the desert night.

The unique virtues that wool possesses such as softness, warmth to the touch, resilience, resistance to creasing, durability and recovery from strain, keep it forever in the light. The obituaries for wool continue to be premature. The old miracle fiber has been thought about to die many times with the introduction of a new fiber by the man-made fiber industry.

Chemists have chased one property after another in their search for a wool-like fiber, but with practically no success in obtaining a likeness to wool. **Nothing measures up to wool!**

It is evident that producers of synthetics would like to avoid using wool altogether in their blends, but to date, such efforts have met with little success mainly on the score of resilience and handle contributed by wool to woven fabrics. Synthetics have undoubtedly established themselves in the field of textile fibers, because in terms of annual production tonnage, they now rank higher than wool.

For the past ten years the American Wool Textile Industry has suffered a 50% contraction, but the future now looks better than ever. It is now evident that the industry's capacity either is, or soon will be, in approximate balance with demand. Such a balance can only lead to greater stability and profitable operations for the plants now existing.

With the introduction of synthetics, growers and processors have intensified their research in the wool and wool textile fields with very encouraging results. A vast research program is going on all over the world today in an effort to provide manufacturers with more uniform qualities of wool and economic processes to produce better wool fabrics to suit specific end uses.

Promoters of synthetics had a "field day" when they spot lighted certain disadvantages of wool such as shrinkage, creasing and insect attack. However, such disadvantages were soon overcome and wool came into a much better position to face competition.

One of the first of these mentioned disadvantages to be overcome was shrinkage and another was moth-proofing. Moth-proofing is now available and is being used in plants throughout the world. Now it is possible to have wool garments that are chemically treated and so labeled that they no longer must be stored away for the summer.

To offset the creasing problem, a method provisionally patented with the trade mark "Si-Ro-Set", is registered and licensed to approved firms to use both the process and the trade mark. This process will thoroughly crease and pleat woolen fabrics.

Along with these accomplishments new and improved scouring techniques are being tested and di-electric heating is being tried to decompose vegetable matter. The full extent of research in America and abroad has to be seen to be appreciated.

With all of this in mind, what has happened to wool in relation to the many man-made fibers which have become a major part of the textile industry?

What really brought about such a change? More than anything else, fashion changes and dress habits have brought havoc with worsteds. The population is dressing more casual the year around and "wash and wear" fabrics are growing in popularity. Fabrics are becoming lighter in weight. Fashion changes have set the pace. Many types of clothing previously made of wool are now made of cotton, rayon, acetate and other man-made fibers or a combination or blends of these fibers. Not forgetting of course, that wool blends are steadily climbing and staying ahead of other blends.

One of today's most successful fabrics is made from 50-50 dacron-wool blends. This blend can be spun on either the cotton or the worsted system. Topmakers have contributed to the industry top-breaking machines that make it possible to blend wool with synthetics and process it on a cotton or a modified cotton system. The price of these blends spun on the cotton system is lower than for those spun on the worsted system. Although fabrics of this blend made from yarns spun on the worsted system are better and more desirable, they may not be enough better to justify the price increase that is necessary when the yarn is spun on the worsted system.

Yarns of special qualities can be produced by blending wool with high and low shrinkage components in the same yarn. When the material made from this yarn is treated with steam or boiling water, the high shrinkage fibers shrink and the diameter of the yarn increases and gives the yarn its lofty and bulky appearance.

For certain purposes, for example, for hosiery, it is now generally recognized that wool blended with synthetics performs better than pure wool. However, blends of dacron with rayon, wool, orlon or cotton are being worn for men's summer suitings and are exploited to the utmost by means of window displays, press publicity, radio and television. Most of these fabrics are inferior in handle to pure wool. However, their promoted advantages and lower price make them attractive to the customer.

It cannot be overlooked that there are today many man-made fibers that surpass the durability of wool, or its strength, and also fibers that are inherently incapable of shrinking and are absolutely moth proof. But try as they may, so far man has not produced a fiber that even remotely resembles wool. It is for this reason that wool fits so well into the various blends.

Lest we forget, wool is still universally esteemed and the high favor in which it is held cannot be ruled out of any consideration of its lasting value. Other things being equal, we know, people will continue to buy wool simply because they prefer it and because it offers comforts that cannot be obtained through other fibers.

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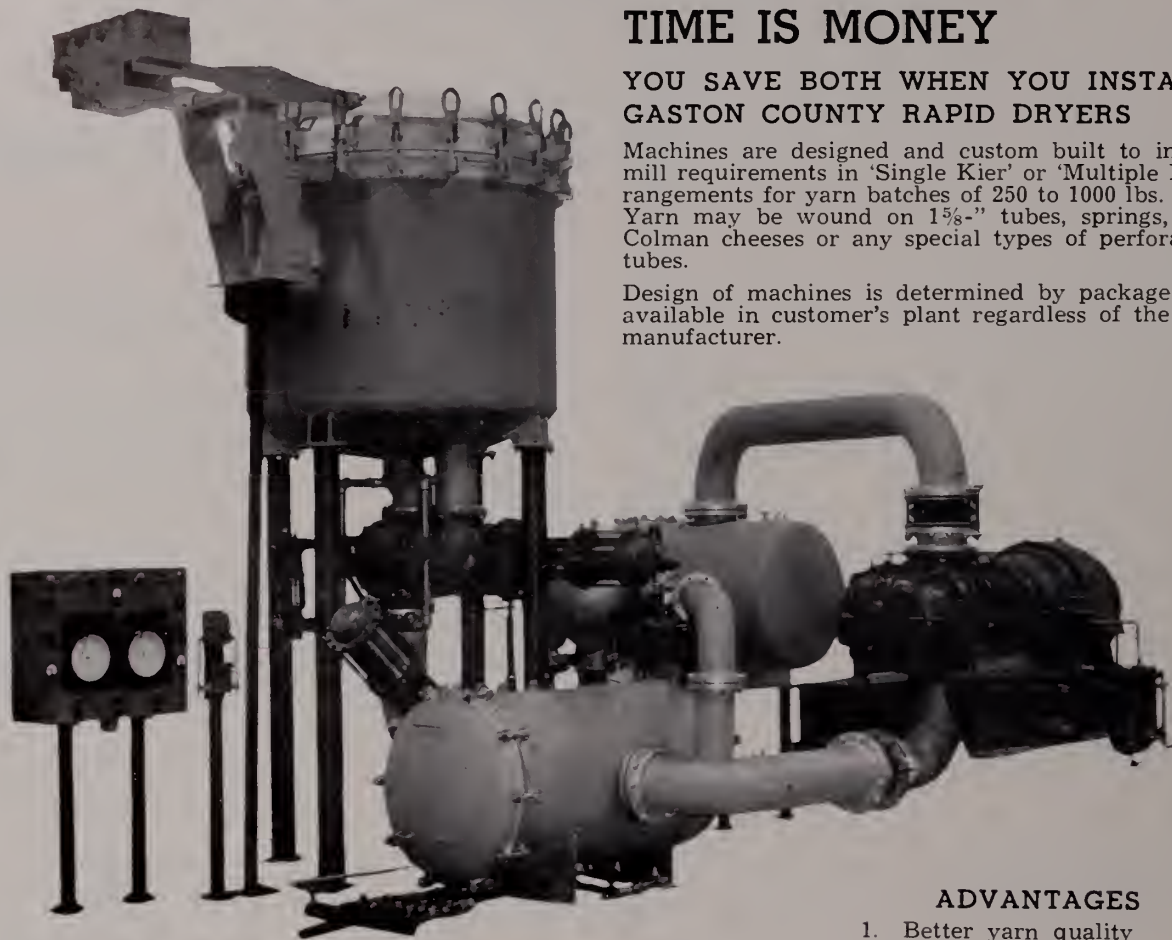
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# Outstanding Seniors . . .

**Charles E. Griffin, Jr.**, is a Textile Manufacturing major from Forest City, N. C. Everett has become familiar to the readers of this magazine by his outstanding efforts as Editor of the BOBBIN & BEAKER.



Everett has already gained much experience in the textile field by working at several different mills during his summer vacations. His first experience came at Stonecutter Mills in Spindale, N. C. The next three summers were spent at Laurel Mills in Rutherfordton, N. C. where he worked in the weave room. This past summer was spent at Judson Mills, Greenville, S. C. Here Everett received experience in the Industrial Engineering Department; he plans to enter this phase of textiles upon graduation.

Much of Everett's school activities are tied to his work for THE BOBBIN & BEAKER. He has served as assistant Managing Editor, Managing Editor, and Editor of this magazine. He also

is a member of S.A.M., the Council of Club Presidents and the Numeral Society. While in the Numeral Society, he has served as President, Vice-President and has been a member of the Executive Council.

Everett's expenses have been partly covered by a Stonecutter Foundation Loan Scholarship.

**William L. Reed**, from Whitmire, S. C., is a Textile Engineering major. Bill received scholastic honors the first and second semesters his Freshman year and is now a member of Phi Psi, the textile honor fraternity, and the Society for the Advancement of Management.



Bill has gotten his experience in the textile field by working five years at the J. P. Stevens plant at Whitmire. He has also worked with the Gaffney Manufacturing Co., Gaffney, S. C., and the Dow Chemical Company, Pittsburg, California.

Before enrolling at Clemson, Bill served a four year tour in the U. S. Air Force. Since entering the Textile School, he has been aided in his school expenses by an American Viscose Scholarship.

**William H. Dill**, a Textile Manufacturing major, is one of our many veterans attending Clemson under the G.I. Bill. He and his wife are presently making their home on the Clemson College Campus.

Bill received scholastic honors the first and second semesters his Junior year and the first semester his Senior year. He has been a member of Phi Psi, the Textile School honorary fraternity, and is now Vice-President of the local chapter.

Bill's experience in the textile industry was gained by fourteen months of work for J. P. Stevens & Company at Slater, S. C. He



plans to return upon graduation and work in the production phase of this mill.

# Properties and Uses of Arnel in Spun Yarn Blends with Cotton

by  
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## SUMMARY

The basic fiber characteristics of Arnel including low moisture absorption, high initial elastic modulus in a hot wet condition, permanent pleatability, improved alkaline resistance over acetate, and excellent dimensional stability contribute to the possibility of constructing fabrics from spun yarn blends of Arnel with cotton which possess ease of care features combined with unique color styling effects.

Blends of Arnel with cotton may be processed on conventional cotton spinning and weaving equipment using either draw frame or picker lap blends. The spun yarn count limit for weaveable warp yarns is in the range of 20-25/1 using 50% Arnel with combed cotton.

Continuous dyeing procedures for dyeing Arnel in blends with cotton using cotton dyehouse equipment have been developed.

Possible functional application for spun yarn blends of Arnel with cotton include flannel sport shirting, pleated skirts, poplin rainwear, chino slacks, bath robes, walking shorts, women's suiting and suit coating and dress goods. Blends of low percentages of Arnel (20%) with cotton in conventional cotton fabrics such as broadcloths, poplins, print cloth, and soft filled sheetings offer unique color design at low costs.

## FUNCTIONAL PROPERTIES

Several important physical and chemical properties of Arnel triacetate contribute to the functional and aesthetic characteristics of fabrics and garments constructed from blends of Arnel with cotton.

Arnel's low moisture absorption, high initial elastic modulus in a hot wet state, the ability to be permanently pleated or creased and excellent dimensional stability contribute to the ease of care features of garments made from blends with cotton. The high resistance of Arnel to alkaline saponification permits compatible wet processing with cotton using slightly modified cotton bleaching formulations.

Figure 1 illustrates the comparative Initial Tensile Modulus for several fibers at various hot wet temperatures. The resistance of Arnel to stretch in a hot wet state is one of several factors important to making garments which resist wrinkling or distortion during laundering. Figure 2 shows the amount of water remaining in various fibers after being wet out and centrifuged for 30 seconds. Low moisture absorption in a saturated condition contributes to faster drying when garments are either drip dried or tumble dried. Figure 3 shows the "drip dry" time for a series of identically constructed fabrics

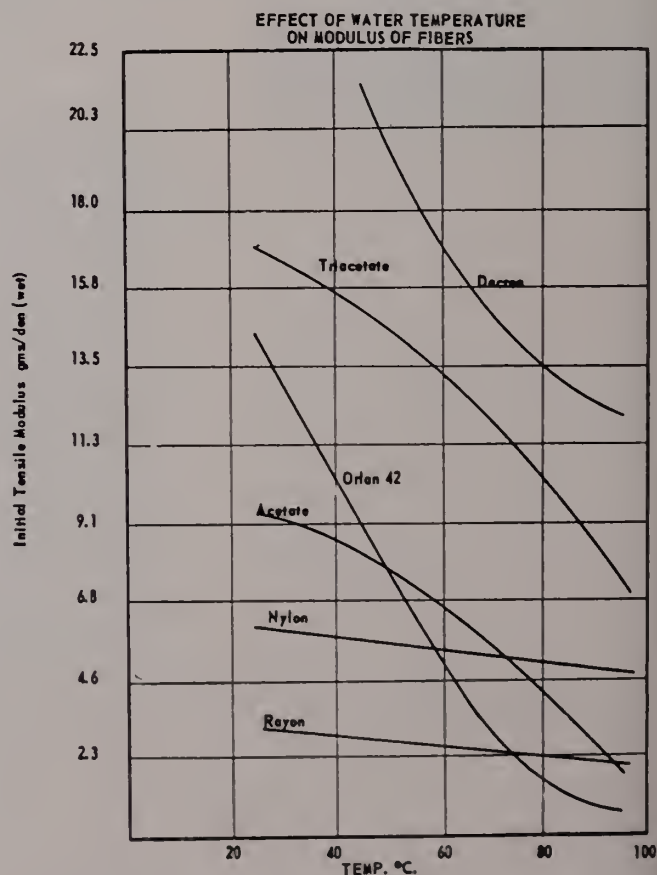


Figure 1  
(Journal of the Textile Institute  
48, No. 6, June, 1957, p. T198)



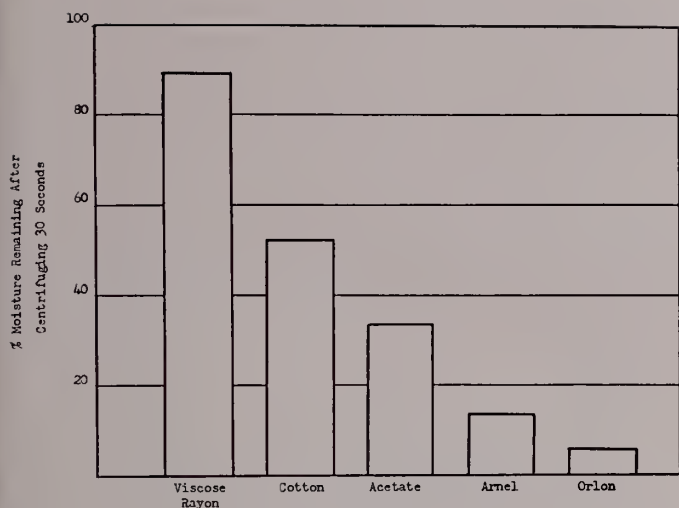


FIGURE 2  
Moisture Present After Centrifuging

made from various blends of Arnel and cotton. Note that 100% Arnel dries in about one half the time required for all cotton fabric.

Examples of ease of care features of Arnel when blended with various percentages of cotton are shown in Figure 4. It is seen that garments constructed from properly designed fabrics containing 50% or more of Arnel show excellent pleat and crease retention after multiple washing cycles and tumble drying without ironing. The resistance to normal wrinkling as a result of wear is almost directly proportional to the quantity of Arnel present.

### AESTHETIC CHARACTERISTICS

In addition to the functional features of Arnel in blends with cotton, the use of these blends offers an excellent opportunity to achieve unique color styling effects at very low costs. The high alkaline resistance of Arnel permits blends of Arnel and cotton to be handled on continuous cotton-processing equipment including mercerization, buffered peroxide bleaching, and continuous dyeing. A recently developed procedure adaptable to many cotton dyehouses now permits Arnel in blends with cotton to be continuously dyed in either one or two passes on a pad steam range in order to produce one color on Arnel and a contrasting color on cotton.

These color styling possibilities are particularly applicable to blends of 20-30% Arnel with 70-80% cotton in conventional cotton fabrics such as print cloths, broadcloths, lawns, soft filled sheetings and poplins. The fabrics may then be overprinted or resin finished as required.

Such fabrics afford the cotton textile manufacturer a unique opportunity to upgrade highly competitive cotton textile fabrics at a minimum increase in manufacturing costs.

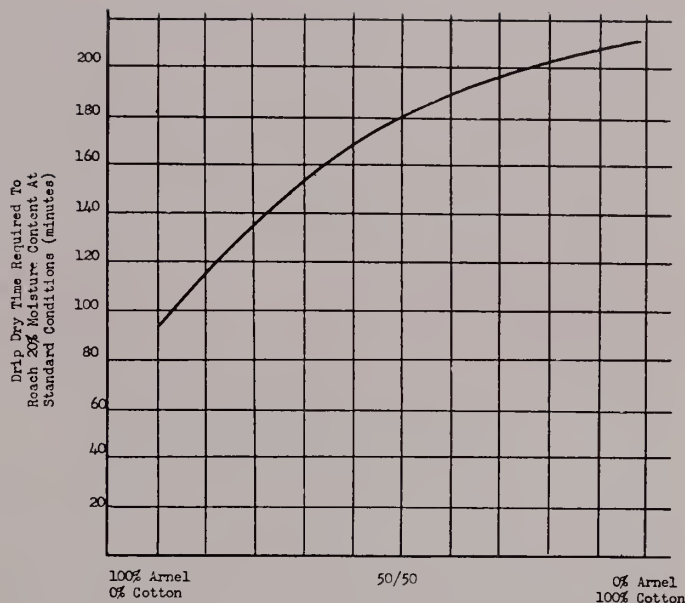


FIGURE 3  
Drip Dry Time  
versus  
Fiber Content

### PROCESSING CHARACTERISTICS

**Yarn Spinning**—The manufacture of spun yarn blends of Arnel and cotton has been accomplished either by preparing draw frame blends or by sandwich blending on a finisher picker and carding the blend together. In either event, it has been found advantageous to employ Arnel of similar cut length to cotton staple length so as to obtain adequate control on drawing frames. Draw frame blends have been prepared by processing through 3 drawings to assure adequate blending.

**Weaving**—The weaving of spun yarn blends of Arnel with cotton poses no special problems except as regards spun yarn count limits and proper design of fabric construction to obtain desired finished fab-

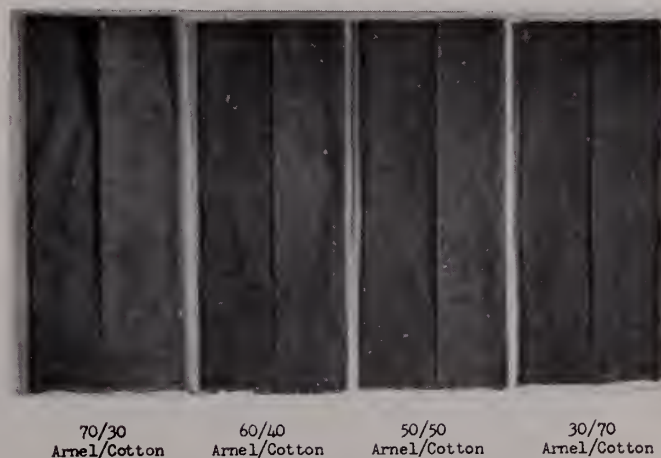


Figure 4

Appearance of Creased Trouser  
Leg After Machine Laundering  
(5 Cycles)



ric constructions. As a general guide the approximately maximum weaveable warp yarn counts are shown below:

Blend Ratio	Suggested Maximum
2.5 d x 1-1/2" Brt. Arnel	
1-3/16" S. M. Combed Cotton	Warp Yarn Count
70% Arnel/30% Cotton	18/1
50% Arnel/50% Cotton	25/1
20% Arnel/80% Cotton	50/1

Conventional starch sizes or water soluble sizes consisting of Penford Gum and Polyvinyl alcohol have been found to process satisfactorily.

#### DYEING AND FINISHING

Blends of Arnel and cotton may either be dyed and finished by batch procedures in typical synthetic dyehouses or by continuous procedures in cotton dyeing and finishing equipment.

Synthetic dyehouse operations include bleaching and dyeing with selected direct dyes for cotton and selected dispersed acetate dyes for Arnel using a one bath procedure. In fabrics containing 50% or more of Arnel, improved color fastness and added resistance to glazing may be obtained by heat treating the fabrics either over hot rolls or in a radiant heater so as to achieve an approximate fabric surface temperature of 420°F. Fabrics dyed in a synthetic dyehouse operation will pass 120-140°F. color washfastness and 10-30 hour lightfastness depending upon the choice of direct dyes and fixative for the cotton dyed portion.

The most recent process for dyeing Arnel/cotton blends consists of a continuous procedure for mercerization buffered peroxide bleaching, and continuously dyeing either the Arnel or cotton on a pad steam range. The dispersed acetate color to be applied to Arnel is dissolved in 10-20% triethyl phosphate and padded onto the fabric at 80-90°C., followed by steaming at 115-120°C. for 15-30 seconds, hot water rinsing and soaping using continuous pad steam range equipment in tandem with a Williams unit and wash boxes. The cotton portion may be dyed simultaneously by first padding on Priocion or

Cibacron dyes and drying before applying dissolved acetate colors on Arnel. Alternately, the cotton may be vat dyed on continuous equipment with selected dyes after dyeing the Arnel portion. Most of the shades dyed using the vat and selected dispersed acetate colors will pass 140°F. color wash fastness and 20-40 hours fadeometer exposure.

The finishing of Arnel/cotton blends is handled in the same manner as the finishing of cotton using either sanforization, everglaze, CRF, or wash and wear finishes. Heat treatment prior to resin finishing is recommended for those fabrics employing 50% or more of Arnel.

#### POSSIBLE APPLICATIONS

The preceding discussions illustrate three areas for use of Arnel in spun yarn blends with cotton. These are outlined below:

- (1) The use of low blend percentages of Arnel (20%) in conventional cotton fabrics to achieve unique color styling effects on cotton dyehouse continuous dyeing equipment.
- (2) The use of about 50% Arnel with cotton in fabrics employing up to 25/1 warp yarn count and in applications not subject to severe wear. The use of Arnel in these fabrics such as skirtings, sport shirtings, poplins, flannels, and gabardines contributes to ease of care and durable pleat and crease retention as well as allowing for versatile color styling using cotton system dyeing.
- (3) The use of up to 70% Arnel in blends with cotton for medium to heavy weight goods where wear resistance and strength are not critical factors. Arnel in such applications allows for the construction of ease of care apparel such as women's suitings, skirtings, sport shirts, bath robes, women's suit coatings, and Bermuda shorts.

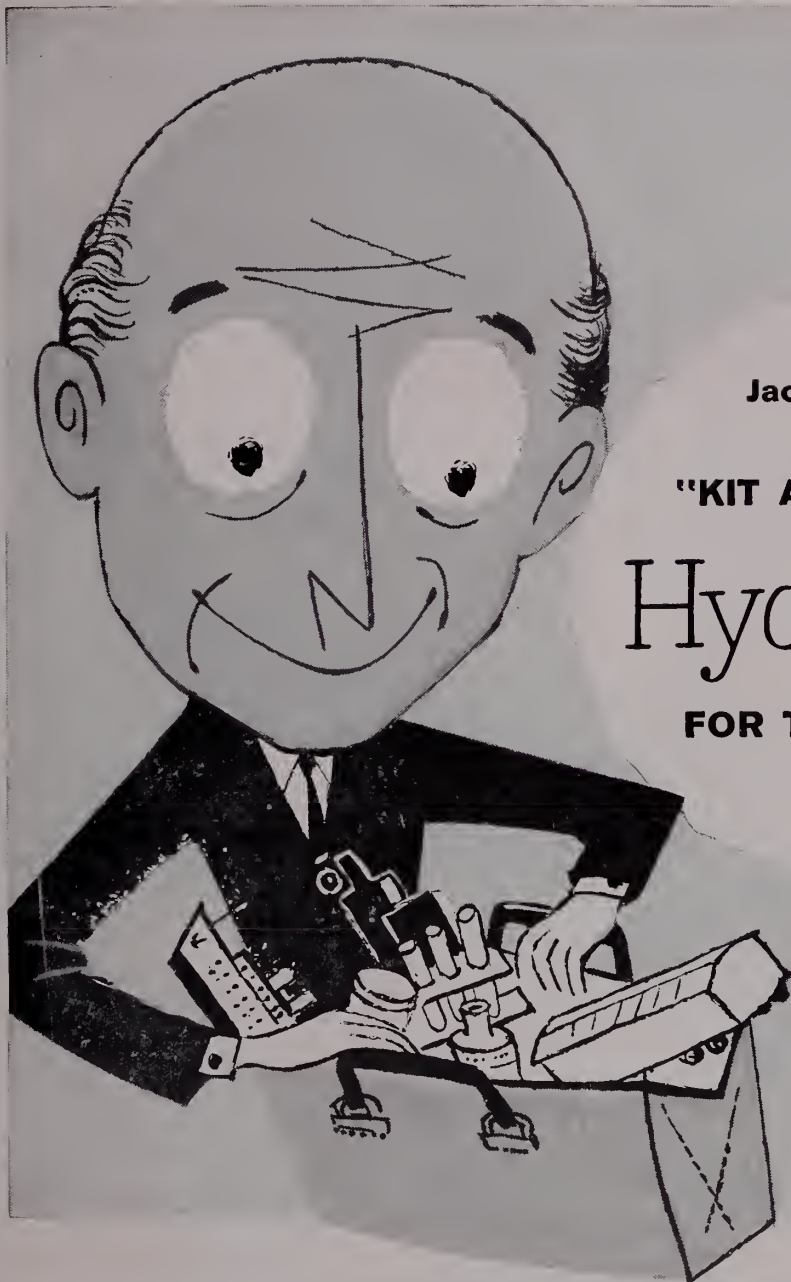
With the advent of increased technology, expanding consumer experience and unique fabric designs by the textile manufacturers, the use of Arnel in blends with cotton will show continued expansion to supply ease of care garments for the consumer.

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